SÜTRON
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User Manual

Maritime Slim Line Touch Panels
Series 2

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Version	Date	Modifications
1	2007-11-08	First Edition

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1 Important Notes

1.1 Symbols

The symbols in this manual are used to draw your attention on notes and dangers.

1.1.1 General Symbols

Danger
This symbol is used to refer to instructions which, if ignored or not carefully followed could result in personal injury.

Note
This symbol indicates application tips or supplementary notes.

Reference to source of information
This symbol refers to detailed sources of information on the current topic.

1.1.2 Specific Symbols

The following symbols indicate specific dangers which could result in damage to equipment or personal injury or even up to the death of the operator.

Danger - Electric Shock

Danger - Corrosive

Danger - Toxic

Danger - Explosive

Danger - Fire

Danger - Infrared Light

Danger - Electrostatic Charge

1.2 Safety Notes

- Read this manual carefully before using the operating device. Keep this manual in a place where it is always accessible to all users.
- Proper transportation, handling and storage, placement and installation of this product are prerequisites for its subsequent flawless and safe operation.
- This user manual contains the most important information for the safe operation of the device.
- The user manual, in particular the safety notes, must be observed by all personnel working with the device.
- Observe the accident prevention rules and regulations that apply to the operating site.
- Installation and operation must only be carried out by qualified and trained personnel.

1.3 Intended Use

- The device is designed for use in maritime areas.
- The device is state-of-the art and has been built to the latest standard safety requirements. However, dangerous situations or damage to the machine itself or other property can arise from the use of this device.
- The device fulfills the requirements of the EMC directives and harmonized European standards. Any modifications to the system can influence the EMC behavior.

This is a class A device. This device may cause radio interference in residential areas. In this case, the user may be required to introduce appropriate countermeasures, and to bear the cost of same.

1.4 Target Group

All configuration, programming, installation, commissioning, operating and maintenance work in connection with the automation system must be performed by trained personnel only (e.g. qualified electricians, electrical engineers, etc.).

The configuration and programming personnel must be familiar with the safety concepts of automation technology.

The operating personnel must have been trained in handling the controller and be familiar with the operating instructions.

The installation, commissioning and maintenance personnel must have an education which entitles them to work on automation systems.

2 Installation and Commissioning

2.1 Unpacking the Device

Unpack all parts carefully and check the contents for any visible damage in transit. Also check whether the shipment matches the specifications on your delivery note.

If you notice damages in transit or discrepancies, please contact our sales department immediately.

2.2 Mounting the Device

When installing the device, leave a gap of at least 30 mm (1.181") around the device to ensure sufficient air circulation.

When the operating device is installed horizontally, please note that additional sources of heat beneath the operating device may result in heat accumulation. Make sure to allow sufficient heat dissipation!
Comply with the allowable temperature range listed in the technical data for the use of the operating device!

To ensure the specified degree of protection, make sure that the seal rests flat on the mounting surface and the threaded pins of the mounting brackets are uniformly tightened.

The device can be easily and quickly mounted from the rear of the device. Ideally, the device should be installed in switch panels with a plate thickness of approx. 1 mm to 6 mm (0.039" to 0.236").

1. Insert the device in the mounting cutout from the front.

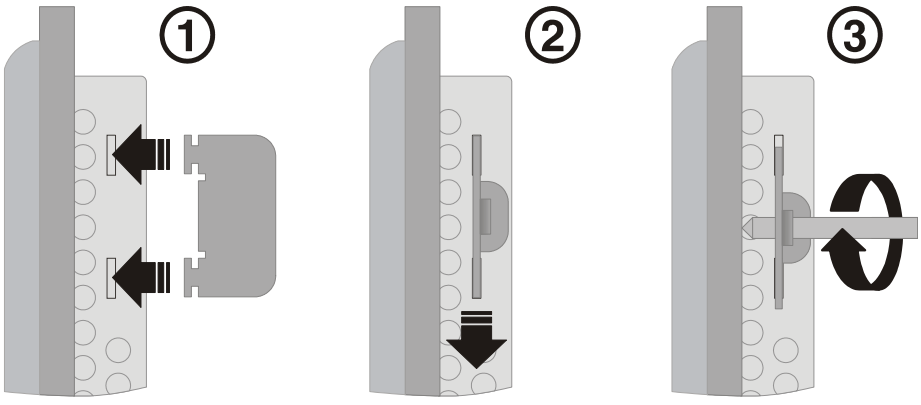

Figure 2-1 Mounting the device using a mounting bracket

2. Insert the mounting brackets into the appropriate openings (figure 1) and pull the brackets downwards until they lock in place (figure 2).
3. Fasten the device into position using the threaded pins (figure 3).

2.2.1 Front Panel Dimensions

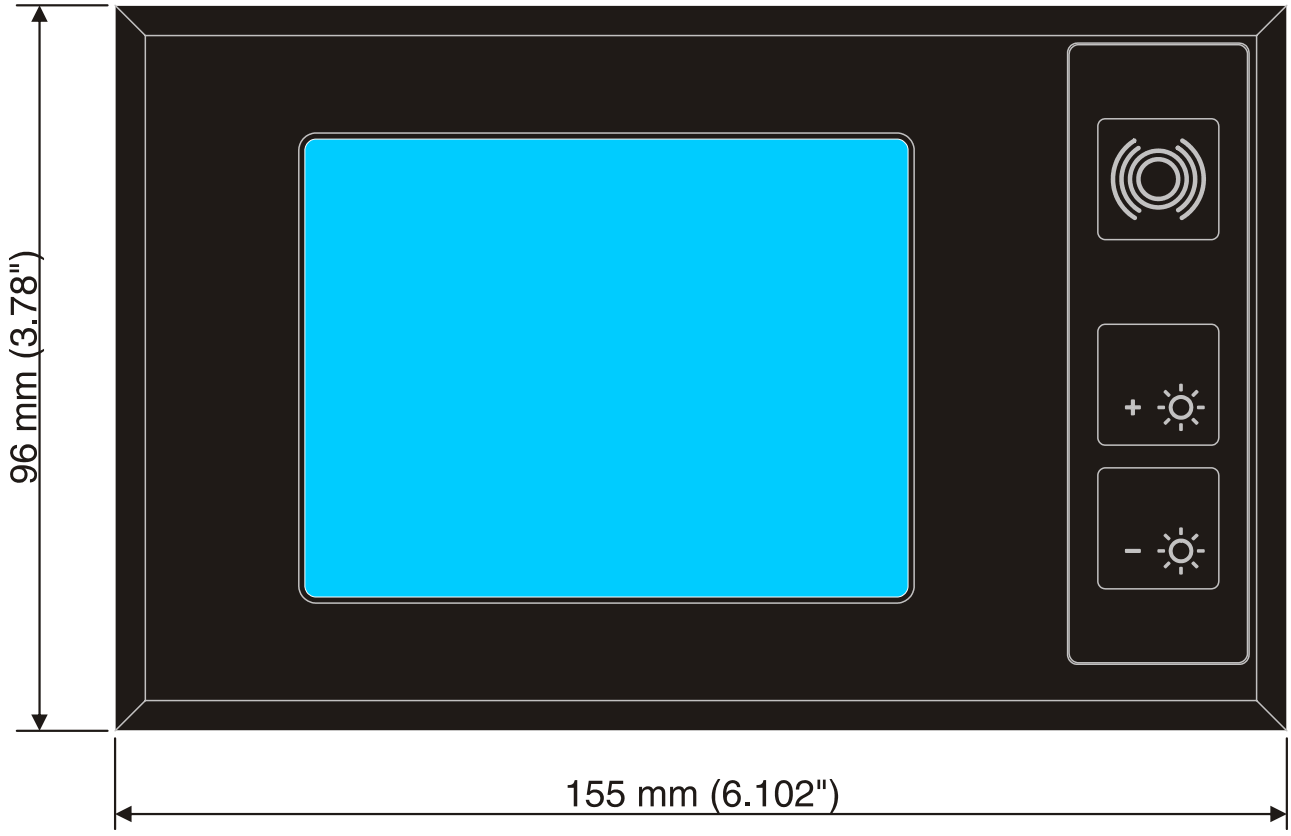

Figure 2-2 TPM11AM

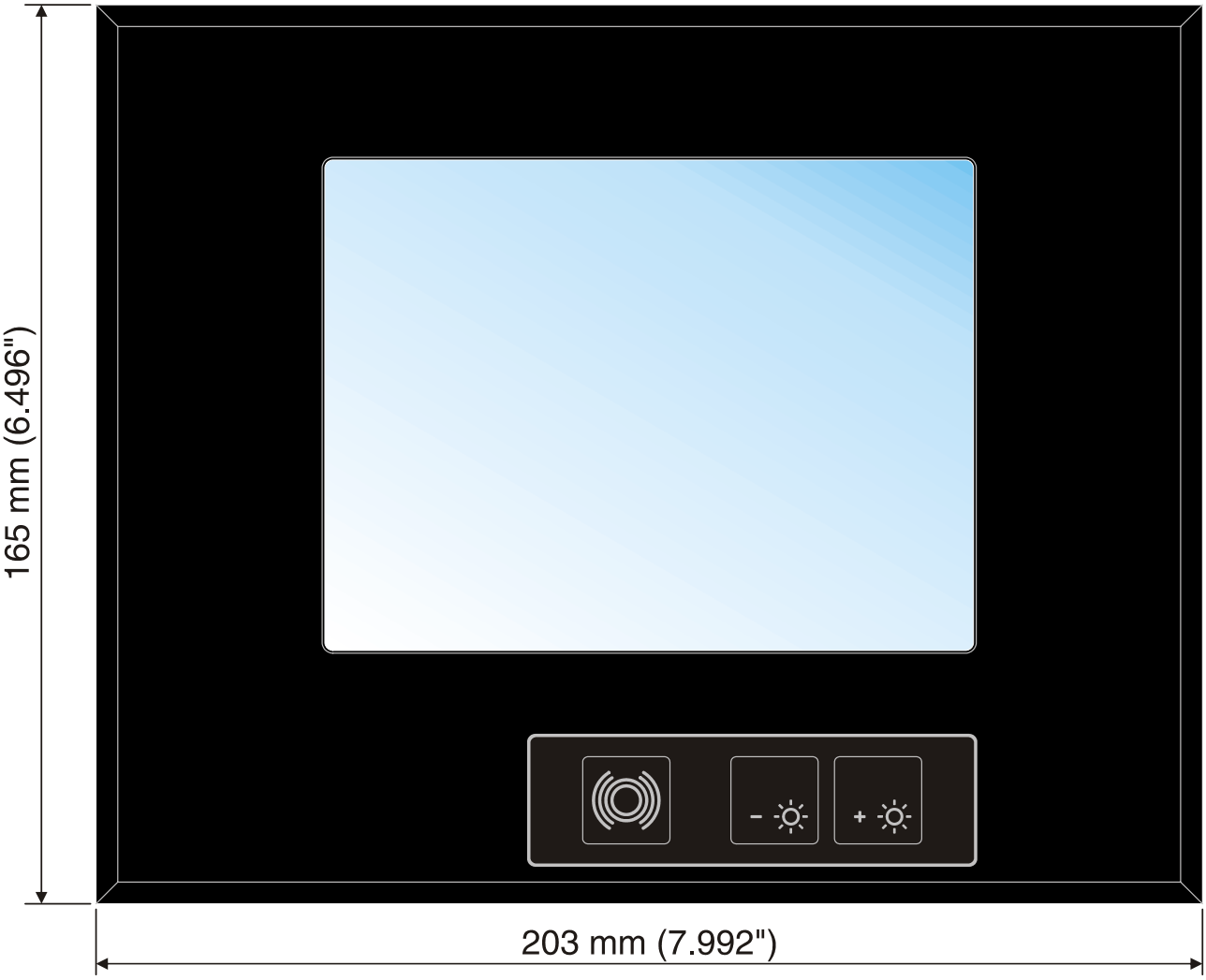

Figure 2-3 TPM21AM, TPM21AS, TPM21AT

Figure 2-4 TPM70AT

2.2.2 Mounting Cutout

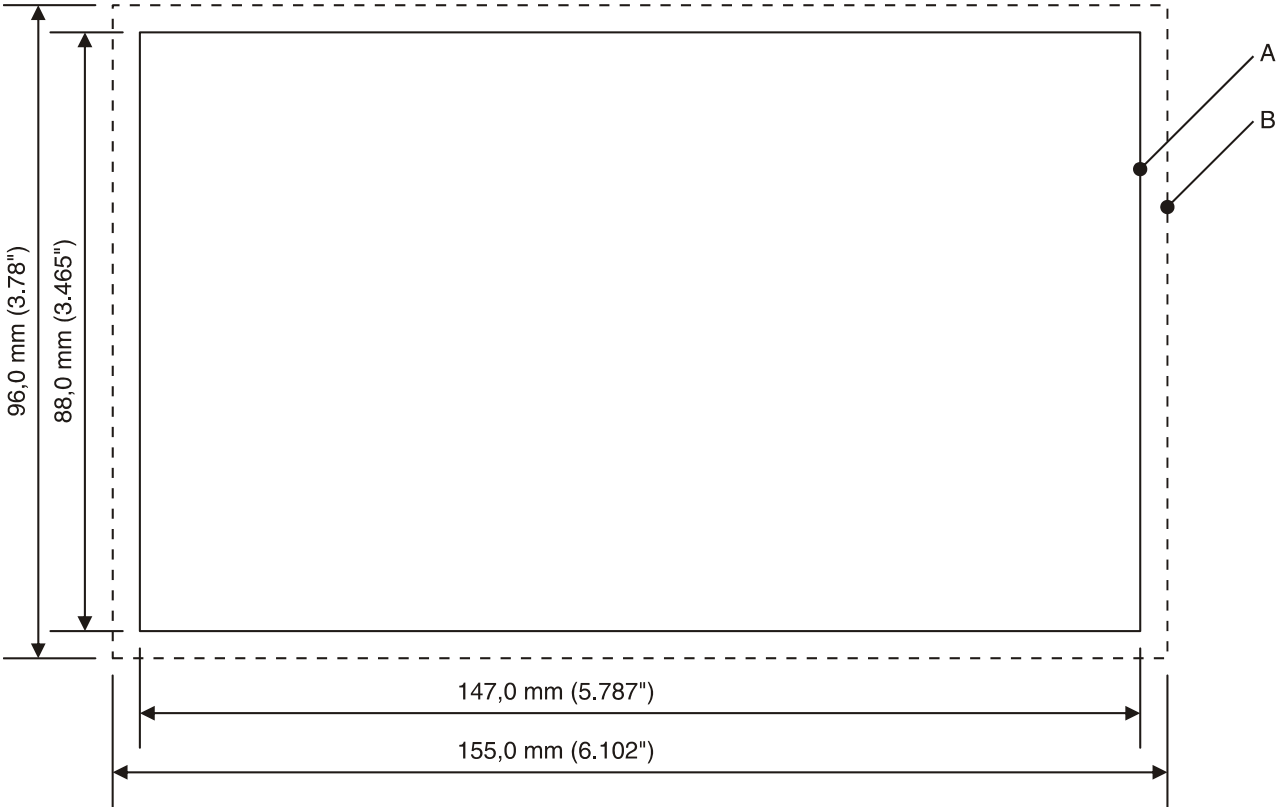

Figure 2-5 TPM11AM

A Mounting Cutout
B Front Panel

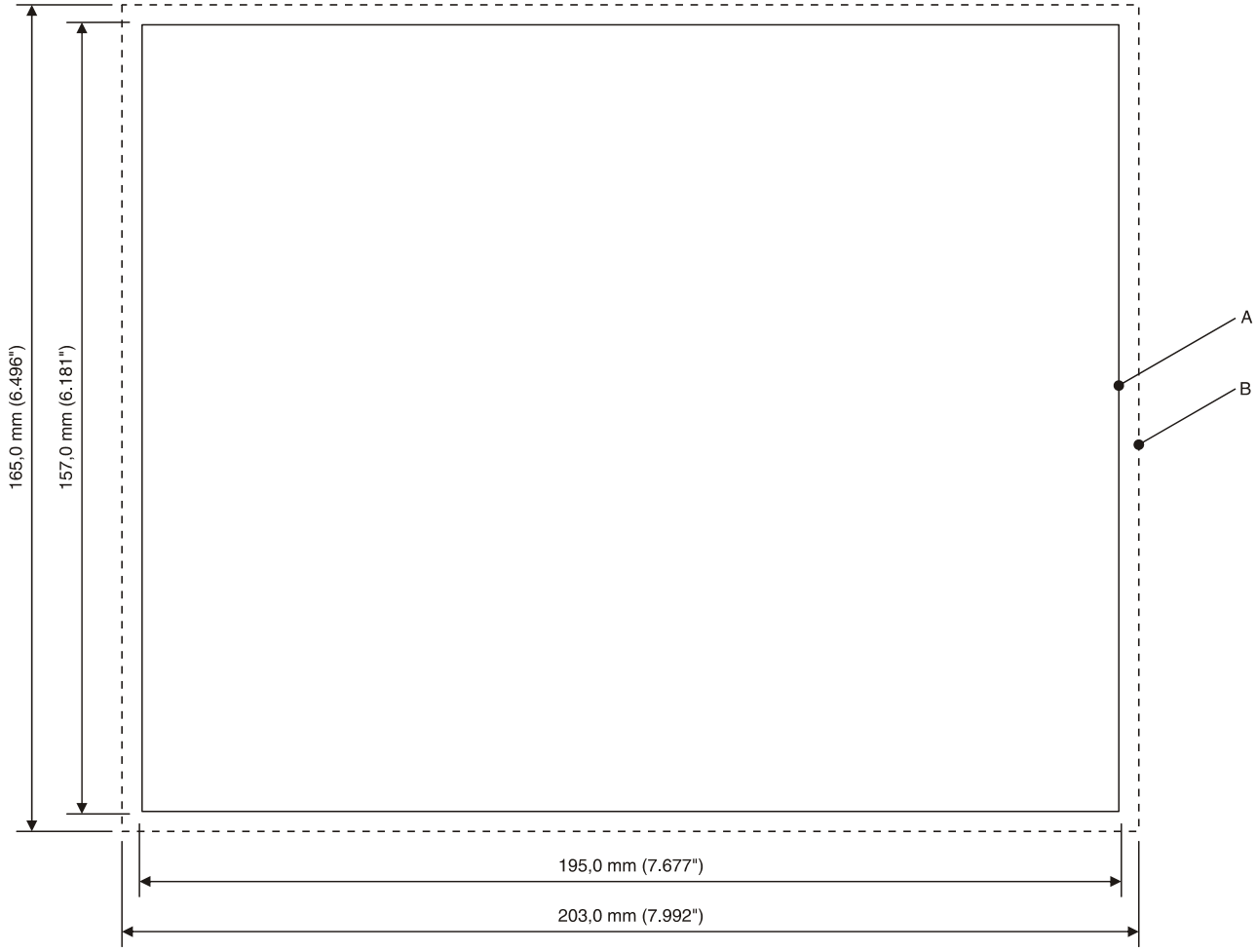

Figure 2-6 TPM21AM, TPM21AS, TPM21AT

A Mounting Cutout
B Front Panel

Figure 2-7 TPM70AT

A Mounting Cutout
B Front Panel

2.2.3 Side View, Mounting Depth

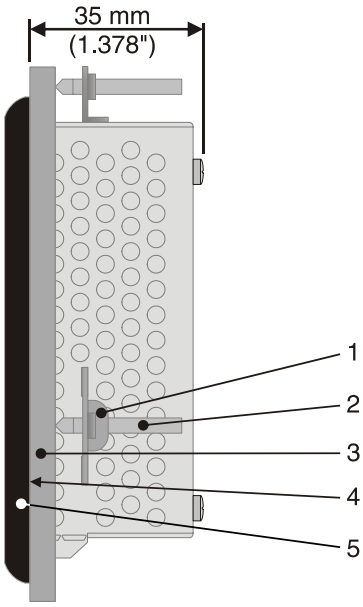

Figure 2-8 TPM11AM

1 Mounting Bracket
2 Threaded Pin
3 Mounting Surface Thickness 1 mm to 6 mm
4 Circumferential Seal
5 Front Panel

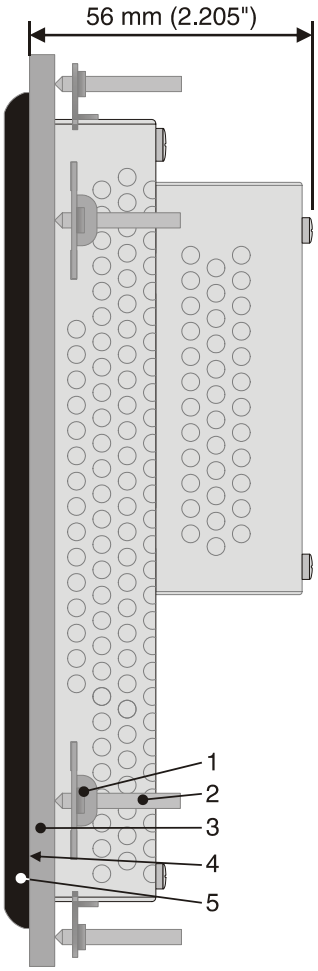

Figure 2-9 TPM21AM, TPM21AS, TPM21AT, TPM70AT

1 Mounting Bracket
2 Threaded Pin
3 Mounting Surface Thickness 1 mm to 6 mm
4 Circumferential Seal
5 Front Panel

2.3 Connecting the Device

2.3.1 Supply Voltage 24 V

The supply voltage is supplied via connector X1.

The device has reverse polarity protection. In case of wrong polarity, the device will not operate.

This is a protection class I device. For safe operation, safety extra-low voltage (SELV) in accordance with DIN EN 61131 must be used for the supply voltage.

Connector in the operating device: 3 pin connector Phoenix COMBICON MSTBV 2.5/3-GF

Table 2-1 Pin assignment supply voltage

Pin	Designation	Function
1	⏚	Low-Noise Ground
2	0 V	Supply Voltage 0 V
3	24 VDC	Supply Voltage 24 VDC

A suitable female connector strip of the type Phoenix COMBICON MSTB 2.5/3-STF is supplied.

Cables with finely stranded conductors with a minimum cross-section of 0.75 mm² (18 AWG) and a maximum cross-section of 2.5 mm² (14 AWG) must be used for the supply voltage.

Hazardous voltages can exist inside electrical installations that can pose a danger to humans. Coming in contact with live parts **may result in electric shock!**

Use the following procedure to connect the device to the supply voltage:

1. Strip approx. 30 mm (1.181") off the outer cable sheath and approx. 5 mm (0.197") off the wires.

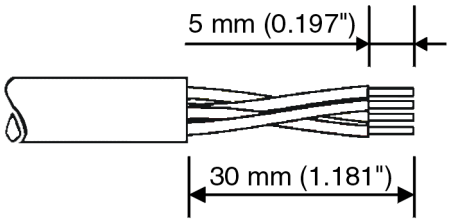

Figure 2-10 Preparing the cable

2. Fit the wires with wire end ferrules and connect the wires to the connector.

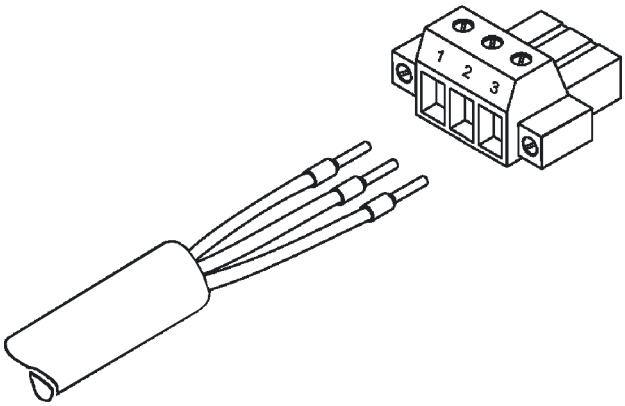

Figure 2-11 Connecting the female connector strip

If shielded connecting cables are used in the supply voltage area, the shield should be connected to pin 1.

3. Plug the female connector strip onto connector X1.

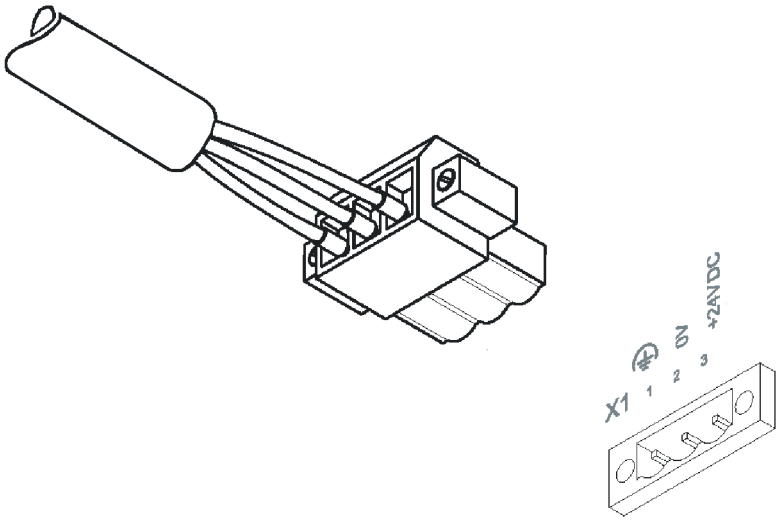

Figure 2-12 Female connector strip is plugged on

4. Secure the female connector strip in place with a screw-type locking to prevent it from slipping out.

A separate conductor must always be provided for the protective grounding at the threaded bolt. The conductor must have a minimum cross-section of 1.5 mm² (16 AWG) and must be kept as short as possible.

2.4 Switching On

The Windows CE operating system is installed on the operating device. Running on the operating system is the visualization runtime software TSvisRT.

2.4.1 Loading Procedure on Windows CE Operating System

The initialization starts the Launch.exe program.

The program allows you to use the keys **Cursor Down** and **Enter** or the buttons to make changes to the configuration.

The Launch.exe program has 3 operating modes:

– Normal (no key / button is pressed)
– Setup Main (Key **Enter** / button **Press For Setup Main Menu** was pressed)
– Administration (**Cursor Down** key followed by **Enter** / **Admin** button was pressed)

2.4.1.1 Normal Mode

The program AppStarter.exe starts from the internal Flash memory.

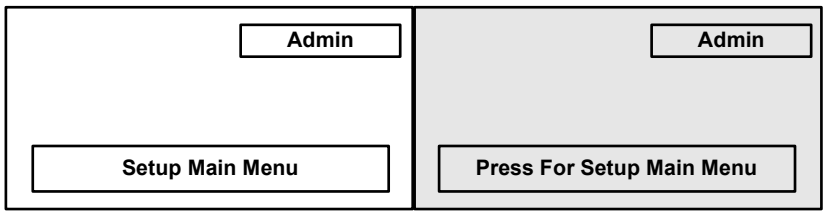

Figure 2-13 Display after startup (operating devices with keys / operating devices with touch screen)

The following message is issued if the AppStarter.exe file does not exist.

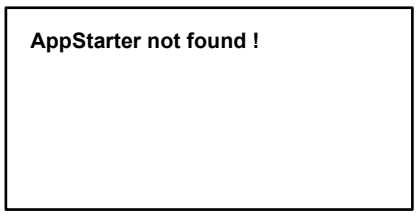

Figure 2-14 Error message after startup

2.4.1.2 Setup Main Mode

If you press the **Enter** key or the **Press For Setup Main Menu** button during the startup phase, the Setup Main mode starts.

The normal entries apply to operating devices with keys only. The gray entries apply to operating devices equipped with a touch screen.

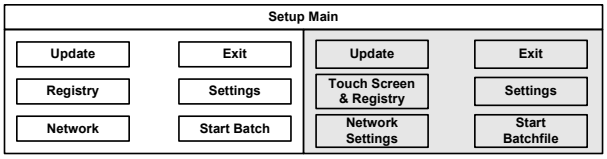

Figure 2-15 Setup Main

Some settings are password-protected. The password is "+-+-".

Update:

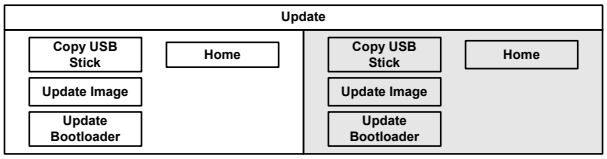

Figure 2-16 Update

Update, Copy USB Stick:

This function copies the data from the USB stick to the internal flash file system.

Several projects can be managed in subdirectories below the directory TSvisRT. If more than one project is in different subdirectories, a choice dialog is displayed. Only directories which contain a project file (xxxx.cb) are listed.

The entire TSvisRT directory or the corresponding subdirectory and the AppStarter.exe are copied into the target directory of the flash file system.

Update, Update Image:

If the „image“ subdirectory on the memory stick contains a xxxx.nb0 file, this file is used to perform the image update. There must only be one xxxx.nbo file in this directory.
In this case, the flash registry is always deactivated so that the image is processed with a new default registry.

Update, Update Bootloader:

If the „bootloader“ subdirectory on the memory stick contains a xxxx.nb0 file, this file is used to perform the bootloader update. There must only be one xxxx.nbo file in this directory.
The user is informed that the update has been successfully completed.

Registry:

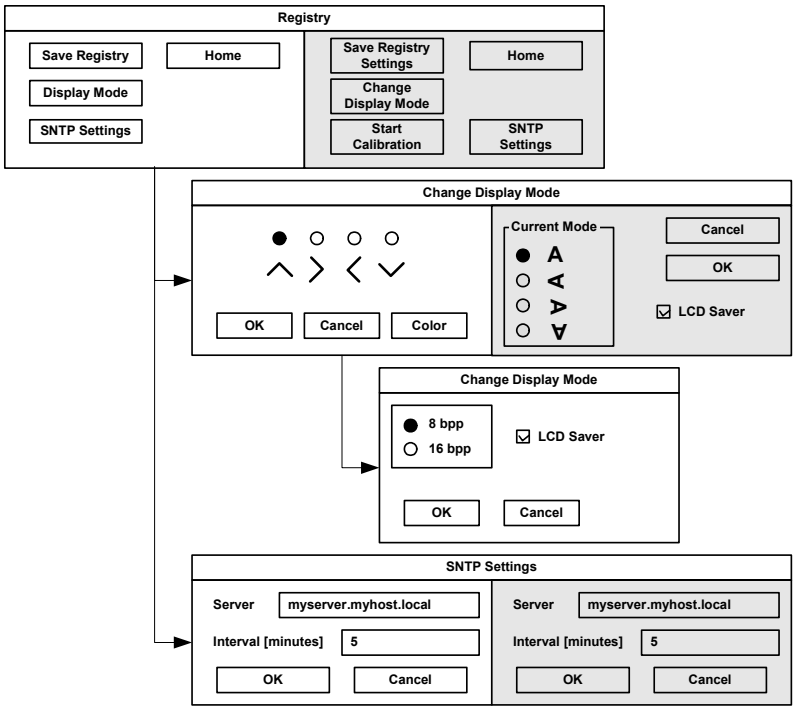

Figure 2-17 Registry

Registry, Save Registry Settings:

The entire registry is saved.

Registry, Change Display Mode:

Set-up of display adjustment.

LCD Saver switches the brightness to the lowest value, if no user operation occures for at least one hour.

This entry is password-protected.

Change Display Mode, Color:

Selection of color depth for TFT displays.

LCD Saver switches the brightness to the lowest value, if no user operation occures for at least one hour.

Registry, Start Calibration:

The touch screen calibration process is started. After calibration, the values are automatically saved in the Registry.

Registry, SNTP Settings:

The name of a time server can be entered via the intranet or internet. The synchronization interval is specified in minutes.

This entry is password-protected.

Network Settings:

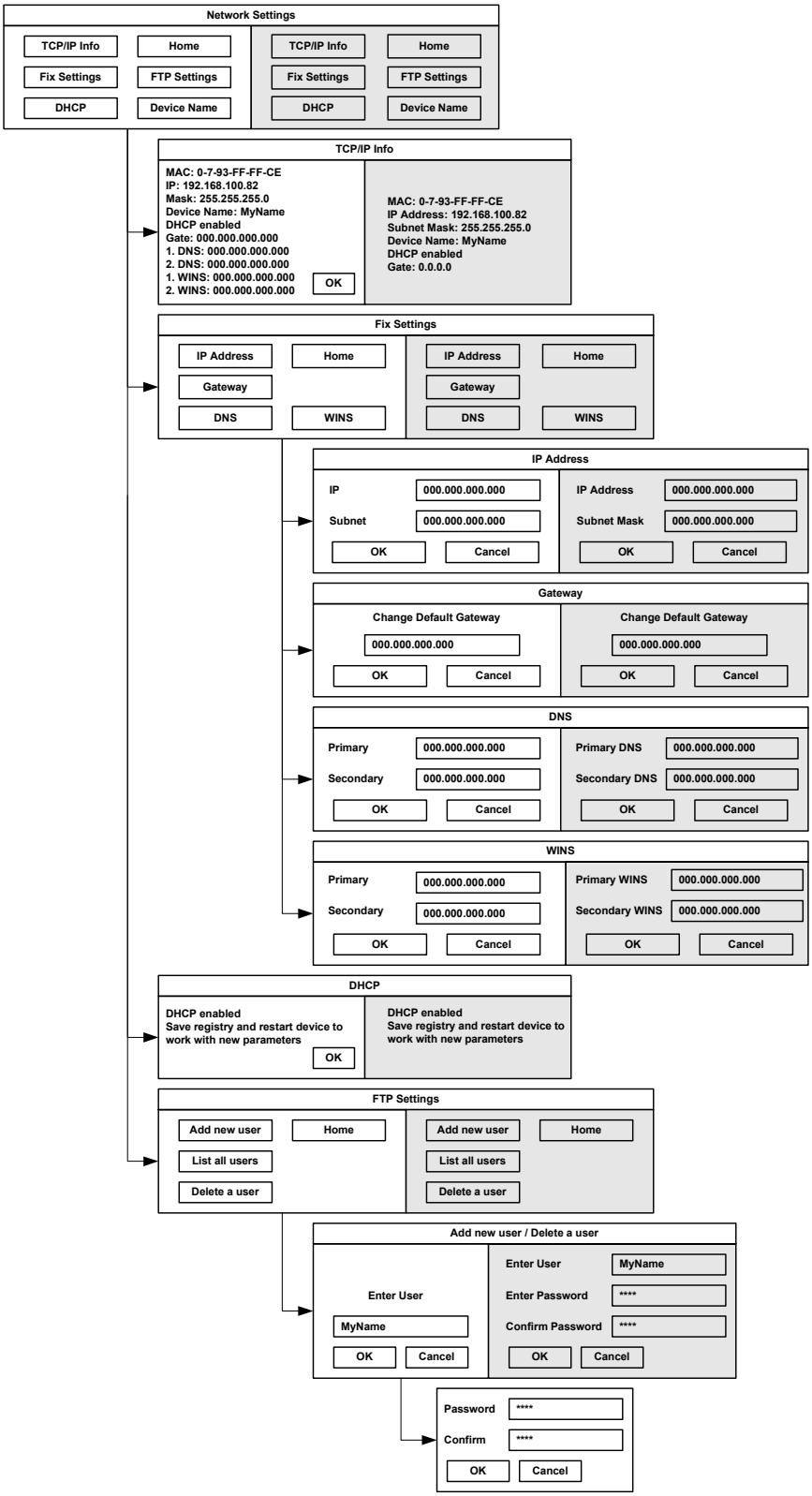

Figure 2-18 Network Settings

Network Settings, Fix Settings, IP Address:

The system deselects DHCP and enters the settings from the IPSetting.ini file of the USB stick. This file must exist in the root directory of the USB stick.
If no USB stick is connected the information is read from the registry.

This entry is password-protected.

Contents of the IPSetting.ini file:

```
[IPCONFIG]
IPAddress=172.016.042.150
SubnetMask=255.255.255.000
```

All addresses must be given in the format "xxx.xxx.xxx.xxx".
Numbers smaller than 100 you have to fill up with zeros.
(Example: 192.168.42.1 -> 192.168.042.001)

Network Settings, Fix Settings, Gateway:

The system deselects DHCP and enters the settings from the IPSetting.ini file of the USB stick. This file must exist in the root directory of the USB stick.
If no USB stick is connected the information is read from the registry.

This entry is password-protected.

Contents of the IPSetting.ini file:

```
[IPCONFIG]
Gateway=172.016.042.150
```

All addresses must be given in the format "xxx.xxx.xxx.xxx".
Numbers smaller than 100 you have to fill up with zeros.
(Example: 192.168.42.1 -> 192.168.042.001)

Network Settings, Fix Settings, DNS:

The system deselects DHCP and enters the settings from the IPSetting.ini file of the USB stick. This file must exist in the root directory of the USB stick.
If no USB stick is connected the information is read from the registry.

This entry is password-protected.

Contents of the IPSetting.ini file:

```
[IPCONFIG]
PrimaryDNS=172.016.042.150
SecondaryDNS=172.016.042.151
```

All addresses must be given in the format "xxx.xxx.xxx.xxx".
Numbers smaller than 100 you have to fill up with zeros.
(Example: 192.168.42.1 -> 192.168.042.001)

Network Settings, Fix Settings, WINS:

The system deselects DHCP and enters the settings from the IPSetting.ini file of the USB stick. This file must exist in the root directory of the USB stick.
If no USB stick is connected the information is read from the registry.

This entry is password-protected.

Contents of the IPSetting.ini file:

```
[IPCONFIG]
PrimaryWINS=172.016.042.150
SecondaryWINS=172.016.042.151
```

All addresses must be given in the format "xxx.xxx.xxx.xxx".
Numbers smaller than 100 you have to fill up with zeros.
(Example: 192.168.42.1 -> 192.168.042.001)

Network Settings, Current IP:

Displays the MAC address, current IP address, subnet mask, device name, DHCP status, gateway, DNS and WINS.

Network Settings, DHCP:

The system enables DHCP. After enabling DHCP this setting must be saved using "Save Registry".

This entry is password-protected.

Network Settings, FTP Settings, Add new user:

You may enter a new user name. You have to assign a password to the user name and to confirm it.

If at least one user name is added you cannot login to the FTP server as anonymous anymore.

Network Settings, FTP Settings, List all users:

All users are listet within a DOS box.

Network Settings, FTP Settings, Delete a user:

You may enter the user name you like to delete.

This entry is password-protected.

Network Settings, Device Name:

You can define a device name with up to 14 characters. Via a FTP connection you can access the device with the device name instead of the IP address.

This entry is password-protected.

Settings:

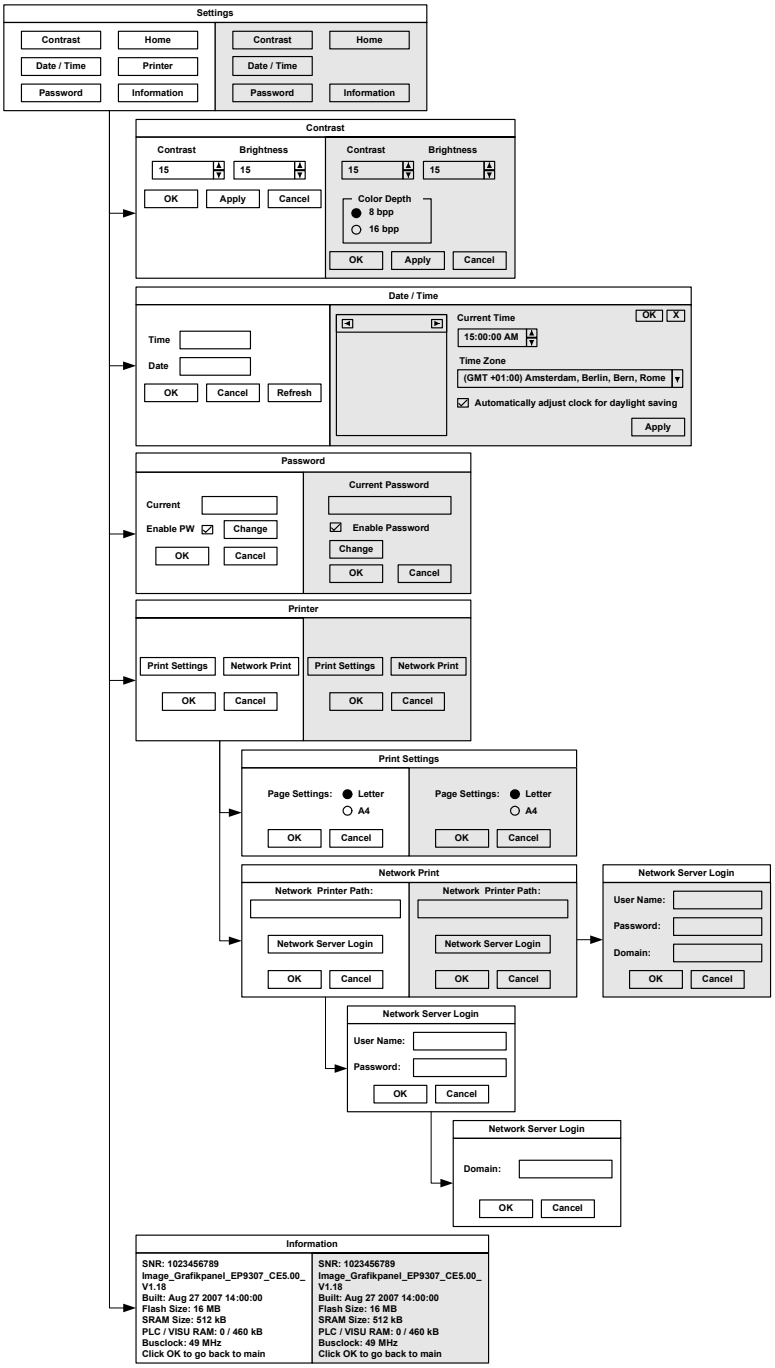

Figure 2-19 Settings

Settings, Contrast:

The operating mode setup main is displayed with default values for contrast and brightness to ensure reading also at faulty values. If you change a value, you have to confirm this in a dialog.

Selection of color depth for TFT displays.

Settings, Date / Time:

Set the date, time and time zone.

Settings, Password:

The password can be activated, deactivated or redefined. When the password is activated, all password-protected dialog boxes can only be accessed if the password has been entered successfully.

This entry is password-protected.

Settings, Printer:

Furcation to „Page Settings“ and „Network Print“.

This entry is password-protected.

Settings, Printer, Page Settings:

Selection of paper format, Letter or A4, Letter is default.

This entry is automatically stored in the registry.

Settings, Printer, Network Print Settings:

Input of the network printer path.

This entry is automatically stored in the registry.

Settings, Printer, Network Print Settings, Network Server Login:

For the network print a network logon can be performed.

Enter the user name, password and domain.

This entry is automatically stored in the registry.

Settings, Information:

The following information is output: serial number, product ID, image version, built version, built date, flash size, SRAM size and PLC / Visu RAM size and the bus clock.

Start Batch:

The **project.bat** file in the **FlashDrv** directory starts, if available.

2.4.1.3 Administration Operating Mode

If you press the **Cursor Down** key followed by the **Enter** key / **Admin** button during the startup phase, the Administration mode of operation starts.

You can use the Admin.ini file to manage the device. This file must exist in the root directory of the USB stick.

This file is used as a dongle to prevent users from changing the device during normal operation.

Possible contents for the Admin.ini file:

Observe upper and lower case for all entries!

Explorer=Off	Deactivates the Explorer in the registry. The change becomes effective on the next device reboot.
Explorer=On	Activates the Explorer in the registry. The change becomes effective on the next device reboot.
Registry=Default	Destroys the current registry and activates the default registry of the image. The change becomes effective on the next device reboot.
Start=MyProgramm.exe	Starts the application MyProgramm.exe
StartRepllog=On	Enables automatic startup of the Repllog.exe program in the registry. The change becomes effective on the next device reboot.
StartRepllog=Off	Disables automatic startup of the Repllog.exe program in the registry. The change becomes effective on the next device reboot.
DeviceName=MyName	Defines the device name of the operating device
Demomode=On	Enables demo mode for TSvisRT. The change becomes effective on the next device reboot.
Demomode=Off	Disables demo mode for TSvisRT. The change becomes effective on the next device reboot.
;Demomode=Off	Comment, no impact

2.4.2 Function of the AppStarter.exe Program

The AppStarter.exe program creates all the necessary registry settings and can also store the registry, if desired.

If the Explorer is activated, the system shuts it down. Automatic startup of ActiveSync is also deactivated.

The AppStarter.exe file then starts the TSvisLD_CE.exe file from the Flash File System (FFS).

2.4.3 Function of the TSvisLD.exe Program

The TSvisLD.exe loads the following components into the memory of the operating system in accordance with the instructions in the TSvisRT_CE.ini file:

– User application
– Protocol driver
– TSvisRT firmware

The program then unpacks the compressed application file (*.CB) and starts the TSvisRT Runtime component.

2.4.4 Memory Media Used

The following memory media are used:

Table 2-2 Memory media used

Operating system memory TSvisRT Runtime Protocol driver Application		**Flash file system** **(FlashDrv)** AppStarter.exe Subdirectory TSvisRT\Project name (with TSvisRT Runtime, protocol driver and application)		USB stick (Hard disk)
		Registry settings		Admin.ini IPSetting.ini
		Image storage in Flash		Subdirectory Image
		Bootloader storage in Flash		Subdirectory Bootloader

Legend:

Copying carried out by operating system

Copying carried out by the bootloader

Copying carried out by the Launch.exe

2.4.5 Important Files and Update

Table 2-3 Important files and update

File	Storage location	Update	Function
TSvisRT_CE.INI	Subdirectory **TSvisRT** or **TSvisRT\Projekt** on USB stick	Transfer via programming software on USB stick or FTP server	Initialization file for TSvisLD_CE.exe
SPSTtxxxxxxx.yyy.DLL	Subdirectory **TSvisRT** or **TSvisRT\Projekt** on USB stick	Transfer via programming software on USB stick or FTP server	Protocol driver
*.CB	Subdirectory **TSvisRT** or **TSvisRT\Projekt** on USB stick	Transfer via programming software on USB stick or FTP server	Compressed application file
TSvisRT_CE.EXE	Subdirectory **TSvisRT** or **TSvisRT\Projekt** on USB stick	Transfer via programming software on USB stick or FTP server	TSvisRT Runtime
EBOOT.nb0	Subdirectory **Bootloader**	Menu item "Update Bootloader" in operating mode setup main via USB stick	Windows CE Bootloader
NK.nb0	Subdirectory **Image**	Menu item "Update Image" in operating mode setup main via USB stick	Operating system Windows CE
AppStarter.EXE	**Root directory** on USB stick	Menu item "Copy USB Stick" in operating mode setup main via USB stick	Starts TSvisLD_CE.exe
TSvisLD_CE.EXE	Subdirectory **TSvisRT** or **TSvisRT\Projekt** on USB stick	Menu item "Copy USB Stick" in operating mode setup main via USB stick	TSvisRT loader
Admin.INI	**Root directory** on USB stick	-	File with administration settings
IPSetting.INI	**Root directory** on USB stick	-	File with settings for IP assignment
project.bat	**Root directory** on FlashDrv		Starts a user-defined application from within the launcher

2.5 Identification

The operating device can be identified using the nameplate on the rear of the device.

Figure 2-20 Nameplate (example)

1 Order number
2 Version key (at time of delivery)
3 MAC address
4 Voltage and power specification
5 Serial number

2.5.1 Version Key

The version key provides information on the version level of various components at time of delivery.

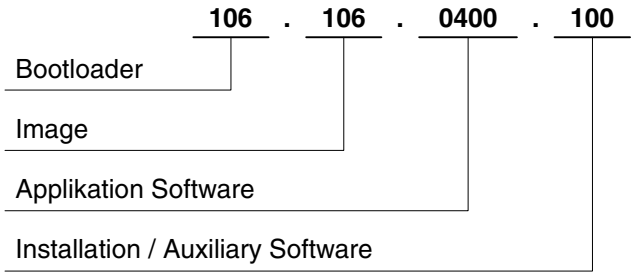

Figure 2-21 Version key (example)

3 Control and Display Elements

3.1 Display

Danger - Toxic!
If the display is damaged, avoid touching, swallowing or breathing in the liquids or gases which may leak out!

Danger - Corrosive!
If the display is damaged, avoid touching, swallowing or breathing in the liquids or gases which may leak out!

The operating device is equipped with different displays depending on variant.

3.2 Dimming

Adjust the brightness to the surrounding conditions at reached operating temperature to be able to read the display optimally.

The **Plus** key encreases the brightness of the display step-by-step. When the key is held down, the function is repeated.

The **Minus** key decreases the brightness of the display step-by-step. When the key is held down, the function is repeated at an automatically increasing rate of repetition.

The adjusted brightness level is stored remanently after after expiry of a waiting time.

With an upcoming alarm message the brightness level is automatically set to a higher level.

Assign the brightness level for upcoming alarm messages with VISU+.

After all alarm messages are acknowledged the brightness is set to the preset level.

3.3 Internal Alarm Indicator

Upcoming alarm messages can be indicated audible by the internal alarm indicator. Simultaneously the relay contact for the external alarm indicator is switched.

Assign the alarm messages which should be indicated by the internal alarm indicator with VISU+.

3.4 Touch Screen

The device is equipped with a resistive 4 wire touch screen. You operate the device using this touch screen.

Pointed or sharp objects, such as pens or fingernails, can lead to irreparable damages of the touch screen. Exclusively therefore use the fingertips or the aids indicated in the technical data for the operation.

To protect the touch screen you can use special protection foils. You receive corresponding protection foils directly from Sütron electronic.

4 Interfaces of the Device

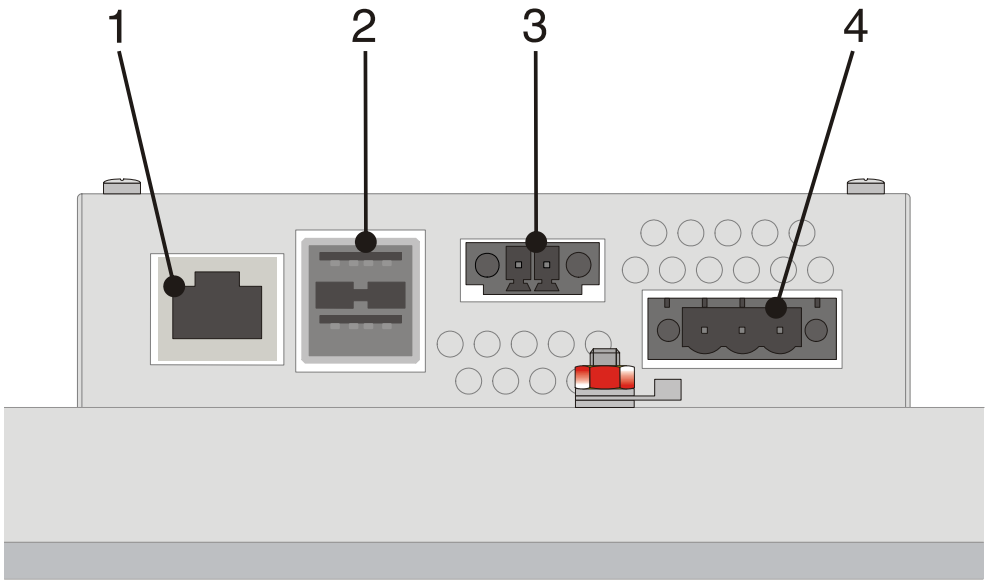

Figure 4-1 Interfaces of the touch panels

1 Female connector X5 (Ethernet)
2 Female connector X9, X10 (USB host - type A)
3 Male connector X6 (external alarm indicator)
4 Male connector X1 (supply voltage)

4.1 Ethernet (X5)

A 10/100 Base-T Ethernet interface is located on the side of the operating device.

4.1.1 Pin Assignment

Connector in the operating device: RJ45 female connector.

Table 4-1 Assignment of the Ethernet interface

Pin	Designation	Function
1	Tx+	Transmitted Data, Positive Polarity
2	Tx-	Transmitted Data, Negative Polarity
3	Rx+	Received Data, Positive Polarity
4	n.c.	Not Connected
5	n.c.	Not Connected
6	Rx-	Received Data, Negative Polarity
7	n.c.	Not Connected
8	n.c.	Not Connected

4.1.2 Cable

A twisted pair cable of the category 5 (CAT 5) type must be used. The maximum cable length is 100 m (328.084 feet).

See the IEEE 802.3 standard for further information.

4.1.3 Diagnostics

Ethernet diagnostics LEDs are located at the side of the operating device.

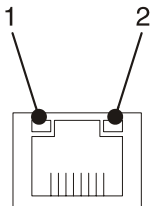

Figure 4-2 Position of the ethernet diagnostics LEDs

Table 4-2 Function of the ethernet diagnostics LEDs

No.	Color	State	Designation	Function
1	Green	ON	XMT	Sending ethernet data telegram
2	Yellow	ON	RCV	Receiving ethernet data telegram

4.2 USB (X9, X10)

Two host interfaces are available on the operating device.

Using the USB interfaces while normal operating mode is not permitted for maritime applications!
For maritime applications the use of the USB interfaces is allowed for servicing operations only!

Using input devices not suitable for industrial use (e.g. keyboard, mouse) may decrease safety of operation. This includes input devices inteded for home and office use.

4.2.1 Cable

For the specification of a suitable cable, please refer to the „Universal Serial Bus Specification Rev. 2.0“.

The maximum cable length for the cable used is 2.5 m (8.202 feet).

4.3 External Alarm Indicator (X6)

The operating device is equipped with a potential-free relay make contact, which is switched simultaneously with the internal alarm indicator.

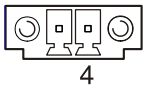

Figure 4-3 Male connector for external alarm indicator (X6)

Connect this output with an alarm indicator which is provided by a separate voltage supply.

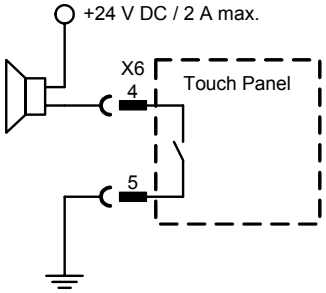

Figure 4-4 Wiring diagram for the external alarm indicator

5 Maintenance and Servicing

5.1 Front Panel

Only use a damp cloth to remove any dirt from the front panel.

5.2 Fuse

The semiconductor fuse cannot be replaced!

A semiconductor fuse is used to protect the device. Once the fuse has been tripped, the device must be disconnected from the supply voltage to allow the semiconductor fuse to regenerate. At an ambient temperature of 20 °C (68 °F), the regeneration takes approximately 20 seconds. The higher the ambient temperature, the longer the regeneration takes.

5.3 Battery

The built-in battery preserves the data in the SRAM and supplies the real-time clock with power. The minimum battery life is 5 years, even under unfavorable operating conditions. When the battery runs down, the message "Change battery" is generated automatically.

We recommend you change the battery approximately every 4 years as part of the regular maintenance work. A prepared battery including connector can be obtained directly from Sütron electronic.

If the "Change battery" message is detected too late, data in the SRAM may have already been lost. For this reason, after changing a battery, always check data such as editable passwords, parameters in the system variables, data sets of the recipes and entries in the message system.

5.3.1 Changing the Battery

At operating devices for the explosive area the batteries must only be changed by Sütron electronic GmbH.

Batteries must only be changed by authorized and trained experts!

For changing the battery you may only use replacement batteries of Sütron electronic.

Electrostatic discharge can damage electronic components! **Observe the ESD protective measures!**

Do not throw lithium batteries into fire, do not heat to 100 °C or higher and do not recharge. **Danger - Explosive!**

Do not open lithium batteries. **Danger - Toxic!**

To ensure that the data in the SRAM and the time are preserved, it is possible to change the battery under operating voltage. Observe the corresponding safety notices!

1. Remove the screws on the rear of the device and lift off the enclosure cover.
2. Remove the cable fastener securing the battery.
3. Disconnect the connector from the battery and remove the dead battery.
4. Plug in the cable for the new battery.
5. Use a cable fastener to attach the new battery to the enclosure.
6. Place the enclosure cover back onto the device.
7. Carefully tighten the screws of the enclosure cover.

5.3.2 Battery Disposal

To prevent short circuitry in the collection boxes, insulate the poles of each battery with insulation tape or put each single battery into a plastic bag.

You must always return old batteries to a dealer or to a returns depot set up for this purpose by the public waste disposal body or a licensed battery dealer for recycling. Only dispose of dead batteries in public or commercial collection boxes. The battery is drained when the message „Change battery“ appears on the display of the operating device.

6 Technical Data

Display	TPM11AM	TPM21AM	TPM21AS	TPM21AT
Type	FSTN (mono)	FSTN (mono)	C-STN (color)	TFT (color)
Resolution (pixels)	320 x 240			
Colors	5 Shades of gray	5 Shades of gray	256	65536
Reading angle	80°	90°	60°	130°
Contrast setting	Temperature compensated	Temperature compensated	Temperature compensated	-
Half-life backlighting	30,000 h	30,000 h	40,000 h	50,000 h
Brightness in cd/m^2	90	120	160	400
Display area (H x W) in mm (Inch)	33,6 x 67,2 (1.323 x 2.646)	86,4 x 115,2 (3.402 x 4.535)	86,4 x 115,2 (3.402 x 4.535)	86,4 x 115,2 (3.402 x 4.535)

Display	TPM70AT
Type	TFT (color)
Resolution (pixels)	800 x 480
Colors	65536
Reading angle	100°
Contrast setting	-
Half-life backlighting	50,000 h
Brightness in cd/m^2	400
Display area (H x W) in mm (Inch)	91,4 x 152,4 (3.598 x 6.0)

Touch Screen	
Type	Analog resistive, 4 wire technology
Activation force	15 g (Standard) With R8 HS60 silicon rubber
Durability	No damages or malfunctions after 3 million keystrokes as the following: Keystroke element: R8, HS40 silicon rubber Keystroke load: 150 g Keystroke frequency: 3 Hz

Keyboard	
Type	Membrane keyboard
Number of keys	2
Key area (raised)	16 mm (0.630") (H x W)
Actuator travel	0.3 mm (0.012")
Actuating force	3 N
Switch cycles	Approx. 3 millionen under the following conditions: Pressing element: test plunger (DIN 42115) Pressing force: 10 N Pressing frequency: 1 Hz
Lifetime (min.)	2 Million switch cycles

Electrical Data	TPM11AM	TPM21AM	TPM21AS	TPM21AT	TPM70AT
Supply voltage	24 V DC (SELV in accordance with DIN EN 61131)				
Residual ripple	10 % maximum				
Minimum voltage	18 V				
Maximum voltage	30 V				
Power consumption (typical at 24 V)	0.25 A	0.25 A	0.4 A	0.4 A	0.5 A
Power consumption (maximum)	0.35 A	0.35 A	0.5 A	0.6 A	0.7 A
Connected load	6 W	6 W	9.6 W	9.6 W	12 W
Fuse	Semiconductor fuse, self-resetting				
Protection against polarity reversal	Integrated				

Ethernet	
X5 Ethernet	10/100 Base-T

USB	
Corresponds to the "Universal serial bus specification Rev. 2.0“	
X9, X10 Host	Min.: 1.5 Mbit/s Max.: 12 Mbit/s Max. output current 100 mA per output

External Alarm Indicator	
Potential-free relay make contact	
X6	Maximum switching voltage: 24 V DC Maximum switching current: 2 A DC

Central Processing Unit	
Central processing unit	RISC ARM9
Clock frequency	200 MHz
Other features	Watchdog timer, real-time clock, battery monitoring

Memory	
Application memory	3 MByte
Flash	16 MByte
SDRAM	32 MByte
SRAM	512 KByte

Connection System
Male connector strip Phoenix COMBICON, 3 pin
Male connector strip Phoenix MINI-COMBICON, 2 pin
RJ45 female connector
USB female connector A

Environmental Conditions	
Temperature during operation	0 °C to 50 °C (32 °F to 122 °F)
Temperature during storage, transport	- 25 °C to + 70 °C (-13°F to + 158°F)
Relative air humidity for operation and storage	10 % to 95 %, no condensation
Application area	Degree of pollution 1, overvoltage category II

Approvals
CE, GL

Standards and Guidelines	
Interference immunity	DIN EN 61000-4-2 DIN EN 61000-4-3 DIN EN 61000-4-4 DIN EN 61000-4-5 DIN EN 61000-4-6 DIN EN 61000-6-2
Emitted interference	DIN EN 55011 limit value class A DIN EN 55022 limit value class A DIN EN 6100-6-4
Equipment requirements	DIN EN 61131-2
Storage and transportation	DIN EN 61131-2
Power supply	DIN EN 61131-2
Electromagnetic compatibility	2004/108/EG
Degrees of protection	DIN EN 60529
Impact load, shocks	DIN EN 60068-2-27
Sinusoidal vibrations	DIN EN 60068-2-6

This is a class A device. This device may cause radio interference in residential areas. In this case, the user may be required to introduce appropriate countermeasures, and to bear the cost of same.

Front Panel and Enclosure	TPM11AM	TPM21AM TPM21AS TPM21AT TPM70AT
Enclosure	Steel sheet, galvanized	
Front panel material	Aluminium, brushed, black anodized	
Front panel (H x W x D) in mm (Inch)	96 x 155 x 5 (3.78 x 6.102 x 0.197)	165 x 203 x 5 (6.496 x 7.992 x 0.197)
Seal	Circumferential rubber seal on the rear	
Mounting cutout (H x W) in mm (Inch)	88 x 147 (3.465 x 5.787)	157 x 195 (6.181 x 7.677)
Mounting depth in mm (Inch)	35 (1.378)	56 (2.205)
Degree of protection	Front: IP65 Rear: IP20	
Total weight	About 500 g	About 1000 g

7 Ordering Data

Table 7-1 Accessories

Description	Part No.
USB 2.0 memory stick 512 MB	81152.512
Battery, assembled with cable and connector (Type: CR2450)	66779.000
Protective foil for touch screen 3,8" (Set with 10 protective foils, scraper and instructions)	81251.038
Protective foil for touch screen 5,7" (Set with 10 protective foils, scraper and instructions)	81251.057
Protective foil for touch screen 7" (Set with 10 protective foils, scraper and instructions)	81251.070
Protective foil for touch screen 10,4" (Set with 10 protective foils, scraper and instructions)	81251.104

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